Service Manual

Shaker

MIR-S100

SANYO Electric Biomedical Co., Ltd.

MIR-S100

SM9910048

Effective model

This service manual is effective following model.

Model name	Model code	Voltage and Frequency	
MIR-S100	823 285 51	115V	60Hz
	823 285 56	110V	60Hz

Contents

Page

Features 1

Specifications 2

Dimensions 3

Electrical parts 4

Wiring diagram 6

Circuit diagram 7

Components on PCB 8

Connections on PCB 9

Control specifications 10

Specifications of Sensor 18

Parts layout 19

Replacement of the bearing 20

Replacement of the base ass'y 24

Replacement of the belt 25

Instruction Manual 27

Features

- The revolution is settable in variable speed, 50rpm~500rpm.
- Auto limit function is installed to make less vibration.
- MIR-S100 is the thin type shaker and it has the low center of gravity to realize less vibration and less noise.
- MIR-S100 can combine with incubator (MIR-153 and MIR-253 and MIR-553) and versatile test chamber (MLR-350).
  The indication on the control panel can be checked with the window of the incubator because the control panel is located in the center of the shaker.
- The stainless steel exterior makes cleaning easier.

Specifications

■Structural specifications

Name	Shaker
Model	MIR-S100
External dimensions	W410 × D305 × H120 mm
Exterior	Body: Painted steel Cover: Stainless steel
Platform dimensions	W380 × D250 mm
Platform	Stainless steel containing copper
Shaking motion	Circling
Amplitude (Shaking diameter)	20 mm
Revolution	50~500 rpm
Allowable load weight	5 kg
Flask intake capacity	MIR-38PFT: 100ml Erlenmeyer Flask x 15, 500ml Erlenmeyer Flask x 5 MIR-38PFN: 100ml Erlenmeyer Flask x 15, 500ml Erlenmeyer Flask x 6
Display	3-digit LED (speeds/time changeable)
Motor	Brushless DC motor (3-phase)
Accessories	Power supply cord
Power source	100-240V, 50/60Hz
Weight	15 kg
Optional component	DAQ communication kit MTR-480, MTR-2000 Platform (MIR-38PFT, MIR-38PFN), Clamp(MIR-51FC, MIR-101FC, MIR-201FC, MIR-301FC, MIR-501FC, MIR-1001FC, MIR-2001FC) Test tube rack (MIR-204SC)

■Functions

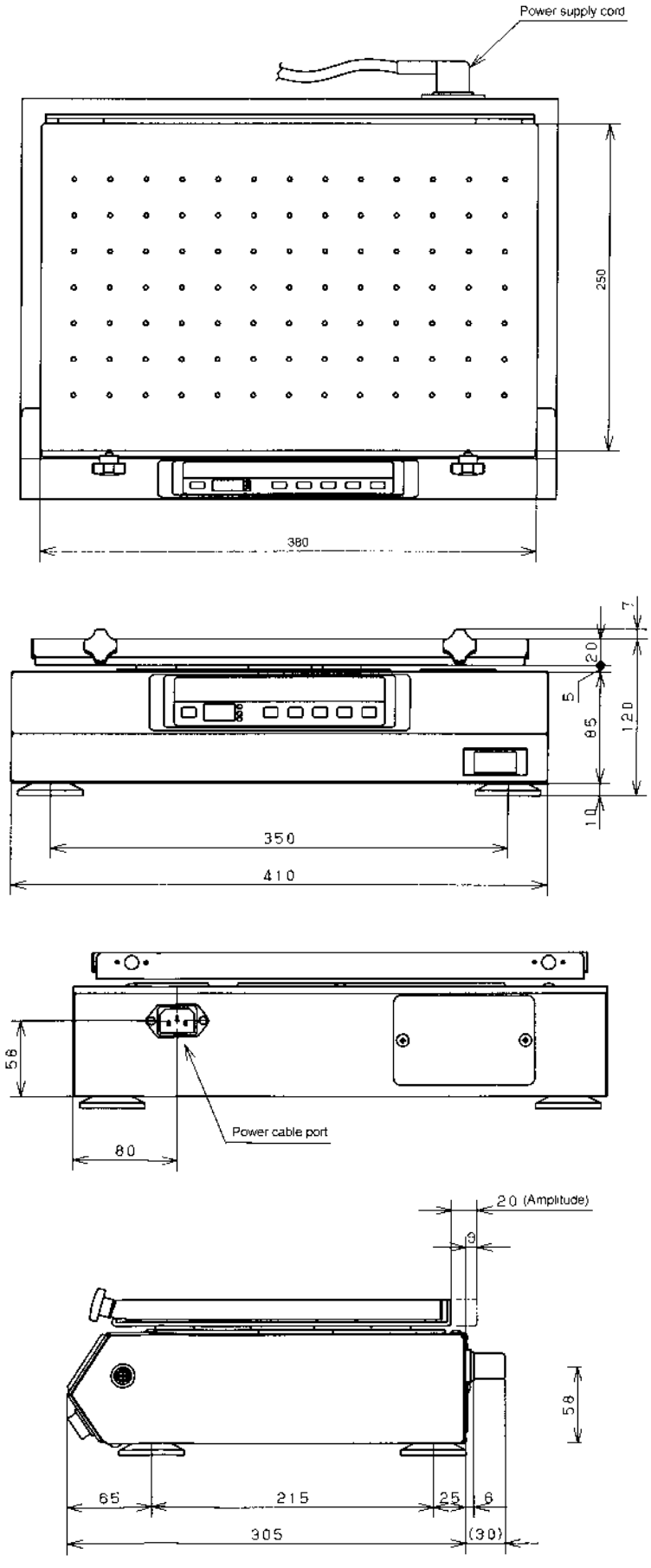
Auto limit	Reduces the revolution speed when it detects abnormal vibration during shaker running. AUTO LIMIT lamp is lit when Autolimit mode is activated.
Rotational acceleration	At the start-up, accelerate the rotational speed slowly to prevent the culture bubbling or spitting from the flask. （acceleration speeds has 3steps, 1, 2, 3）
Timer	Changeable 0.0~99.9 hours, timer counts up 6minutes increment in more than 6 minutes indication. （Counts up/down 1seconds increment/decrement in equal or less than 5 minutes and 59seconds）
Total running time	Total running time can be checked in function mode.
Key lock	The key in the control panel is not able to operate by.
Auto start after power failure	Restarts operation after power failure. “PF” and revolution are alternately displayed.
Revolution abnormality	“E07” flashes when revolution doesn’t arrive setting speed or over setting speed.
Motor overload protection circuit	Stops automatically the operation when the motor is overloaded and the over-current is detected. “E06” flashes.
Over-current breaker	The power switch serves as breaker
Motor protection	When the internal temperature goes higher abnormally, the unit stops operation with the alarm occurred.
Maintenance notice	When the total running time is reached in 10,000hours, “CH1” flashes twice after the power turns on.
Failure predicting	Arrival time up to 100rpm (up to the setting rpm in the case of rpm less than 100rpm) is 90 seconds or more, “CH2” flashes twice and the diagnosis should be done that mechanical components are abnormal.

■Performance

Usable environment condition	Temperature: 0~60℃ Humidity: equal or less than 80%R.H.
Maximum power consumption	27 W
Maximum total current	0.27 A
Maximum heat emission	97 KJ/h

* These data based on our measuring method.

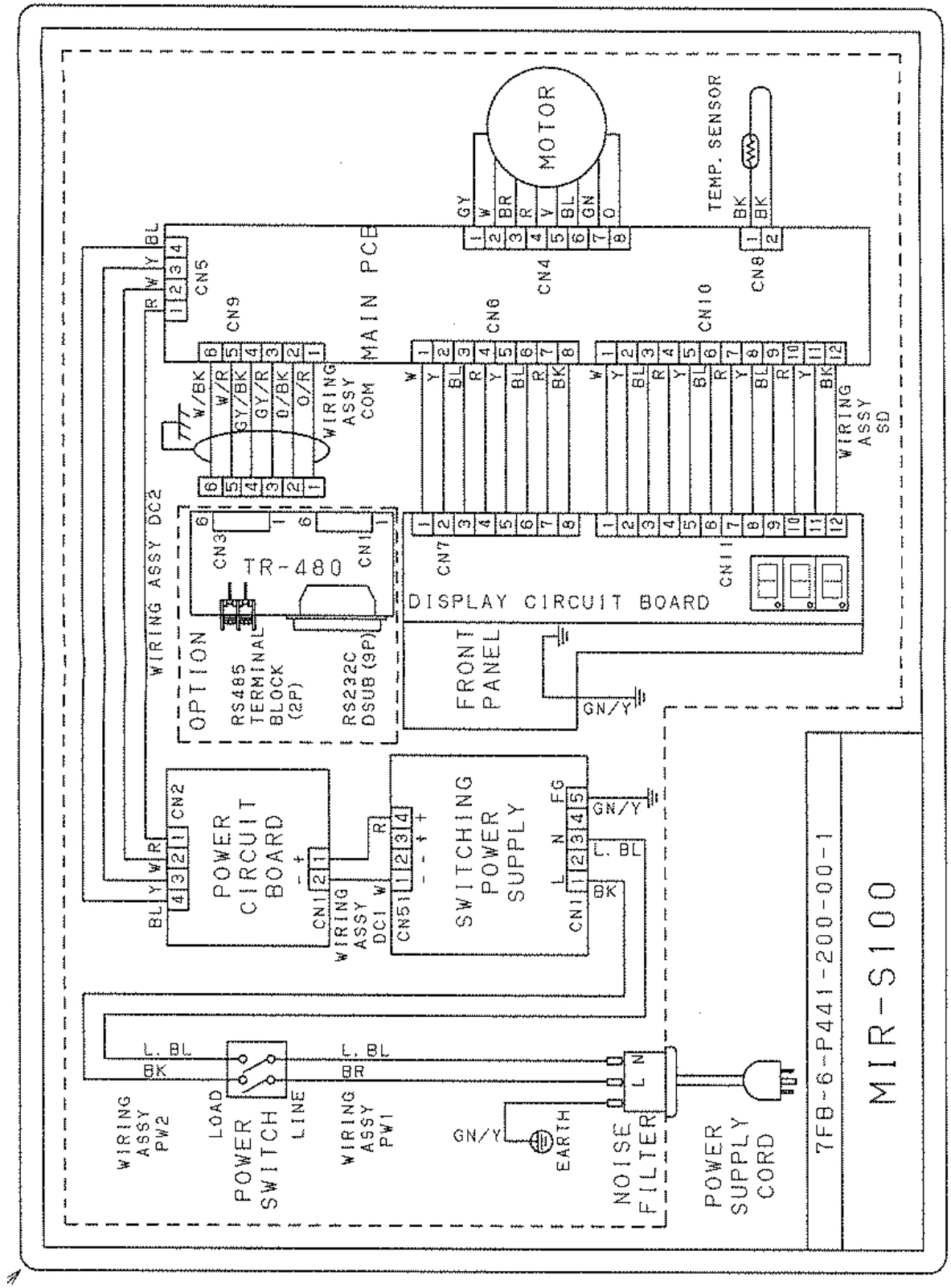
Dimensions


Power supply cord
250
380
7
20
5
85
120
10
350
410
56
Power cable port
80
20 (Amplitude)
9
58
65
215
25
6
305
(30)

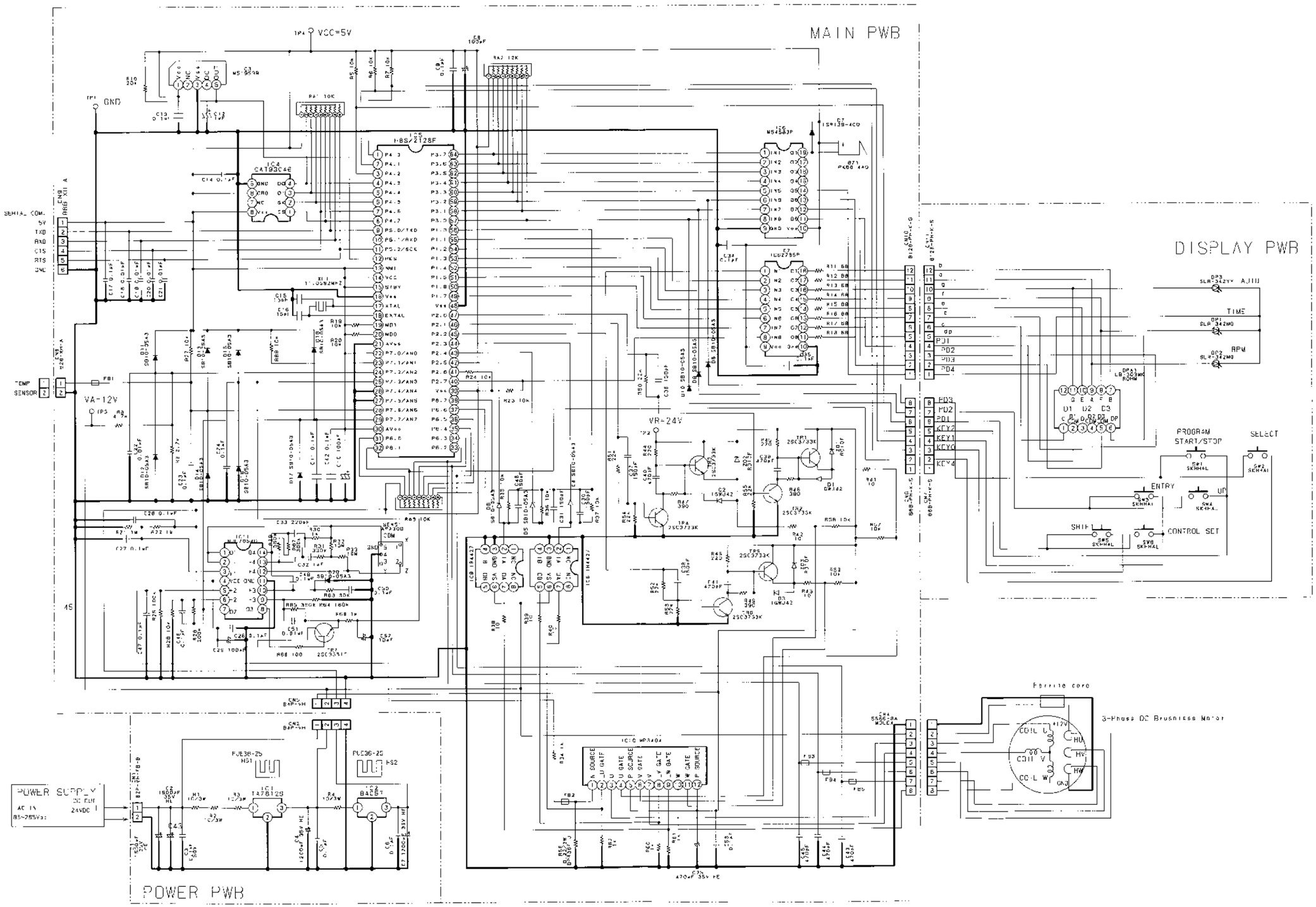
Electrical parts

Part name	Specifications
Noise filter	Type: ZUG2210-11 Rating: 10A
Power supply cord	Rating: AC125V, 12A
Motor	Type: FY8S25H-D3
Power switch	Type: BAM205171 Rating: AC250V, 5A
Switching power supply	Type: ZWS50AF-24/J Rating:AC24V, 50W
Temp. sensor	Type: 103AT-1 Rating: 10KΩ, 25℃

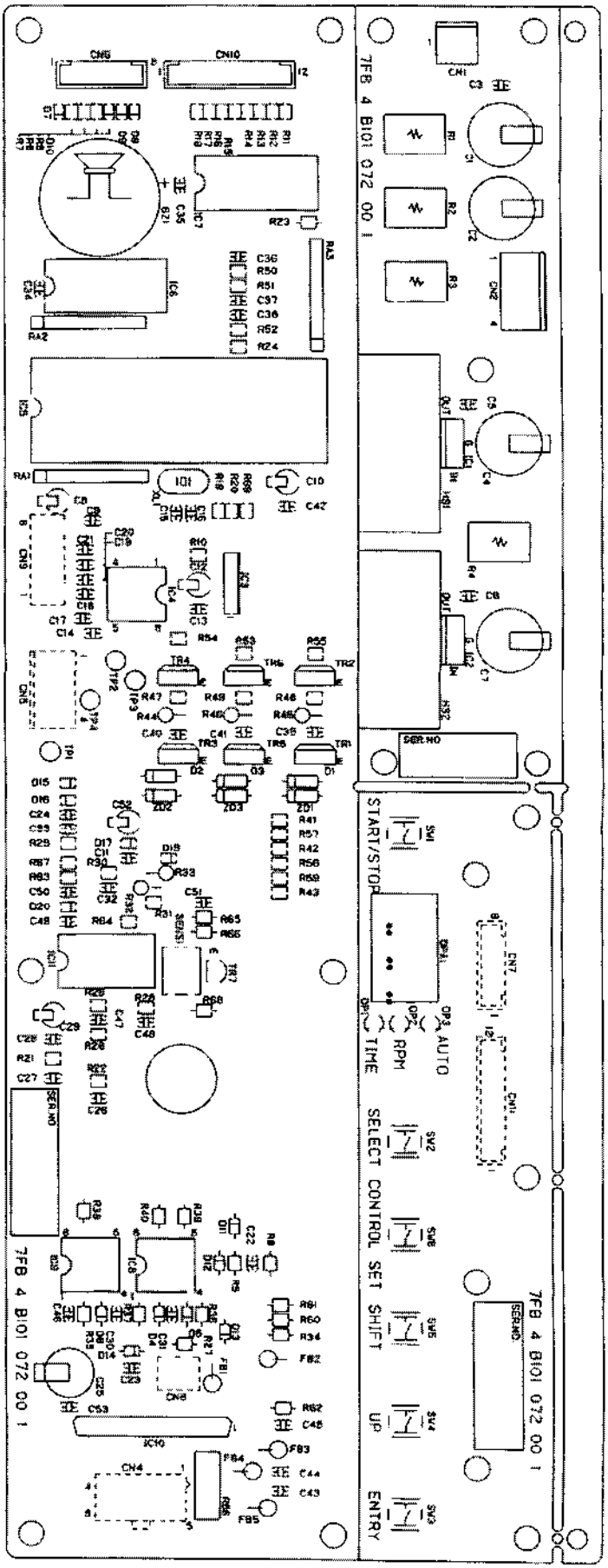
Wiring diagram



Circuit diagram



Components on PCB



Connections on PCB

Following shows the connections on the PCB.

Connecter	Connects to		Usage
CN1	Switching power supply	CN1: #1-#3 100V CN51:#1-#4 DC24V	To supply the power to PCB.
CN2	Main PCB	#1-#4 DC24V #2-#4 DC12V #3-#4 DC5V	To supply the power to PCB.
CN3	CN9 on Main PCB		To communicate with PC.
CN4	DC motor	#1-#2 DC12V	To control brushless DC motor.
CN5	Power PCB		To connect with Power PCB.
CN6	Display PCB		To connect with Display PCB.
CN7	Main PCB		To connect with Main PCB
CN8	Temp. sensor		To detect the internal temperature.
CN9	MTR-480		To connect with MTR-480 (option).
CN10	Display PCB		To connect with Display PCB.
CN11	Main PCB		To connect with Main PCB.

Control specifications

1. Key and Switch

SELECT : Press the key to change over the setting value (SV) or present value (PV) from revolution and time indicator.

SET : Press this key to enter revolution set mode or running time set mode.

▶▶ : During setting mode, the blinking digit shifts among the 1st digit or the 2nd digit or 3rd digit. Press this key over 5 seconds to enter key lock mode.

▲ : During setting mode, count the blinking digit up. In PV display, press the key over 5 seconds to enter the function mode. (“F00” is displayed)

ENT : In setting mode, function mode and key lock, press the key to enter the value to be stored in non-volatile memory.

START/STOP : Press once the key to start the operation. Press again to stop the operation. Press this key over 3seconds to change over auto limit function on or off.

2. Setting range and indication examples

Revolution setting range : 50~500 rpm
Running period setting range : 00.0~99.9 hours (0.1hours increment)
Set in 00.0 to run the unit continuously.

Indication examples :

Revolution	“362 rpm”	362
Time	“1.2hours”	1.2
Time	“5minuites and 45seconds”	5.45
Time	“15hours and 24minutes”	15.4

3. Alarming function and self-diagnosis function

Alarms

E06: Abnormal current in the motor
E07: Abnormal revolution
E08: Abnormal temperature

If above errors detected;
- Unit stops operation
- Error code and revolution (or running period) are displayed alternately.
- Continuous buzzer beeps.

To release errors, turn the power off then on.

E06: Abnormal current in the motor
The current in the motor should be exchanged to the voltage.
E06 is displayed when the voltage is over than 3.5V (0.8A) with 20times amplified, or when the voltage is over than 0.9V however the revolution is 0 rpm.
When the detected voltage is over than 0.9V without the signal changed for 255msec, E06 is also displayed.

E07: Abnormal revolution
E07 is displayed when the revolution (displayed value) is less than 10 rpm with 30seconds passed since the unit start running, or when the revolution (displayed value) is less than SV-20rpm with 120seconds passed since the unit start running, or when the revolution (displayed value) is stabled (reached to SV±2rpm) for 15seconds then it is out of SV±10rpm for 60seconds.

E08: Abnormal temperature
When the thermistor detects over than 72°C, E08 is displayed.

Power failure alarm: "PF" and revolution are alternately displayed when the power retrieves from the power failure. The revolution is automatically recovered.
Press any key on the control panel to release "PF" indication.

Failure predicting function

There are 2 predicting codes (CH1 & CH2) to notify the abnormality of the unit to blink the code twice when the power is supplied again. Buzzer does not beep.

CH1: Accumulating running time is over than 10000 hours.

CH2: Abnormal revolution
In SV is over than 100 rpm, CH2 is displayed when it takes over than 90seconds to reach to 100rpm since the unit starts running.
In SV is less than 100 rpm, CH2 is displayed when it takes over than 90seconds to reach to SV-2rpm since the unit starts running.

When the power is supplied again, CH2 would be blinked twice if the unit detected the CH2 in the last running.
CH1 has the priority to CH2.

4. Key Lock

Press ▶▶ key for 5seconds to blink "L 0" on the display. Set "1" to the blinking "0" with ▲▲ key and press ENT key to enter key lock mode.
In key lock mode, press ▶▶ key for 5seconds to blink "L 1" on the display. Set "0" to the Blinking "1" with ▲▲ key and press ENT key to release key lock.
During key lock mode:

- START/STOP key is unacceptable
- ▲▲ key and ▶▶ key are unacceptable, that's the current setting is not changeable.
- Function code is changeable.
- Key lock mode is available when the power is turned off then on.

5. PV auto return

If there are no key operation for 90seconds during setting mode or key lock mode or function mode, the value is not stored in non-volatile memory and automatically revert to PV display.

6. Zero adjustment

Set the function code "F24" on the control panel to adjust the revolution. See F24 of "7. Function mode" for details.

7. Function mode

F00 Automatically revert to PV display
F06 Service code input (code: 384)
F09 Non-volatile memory (EEPROM) initialization
F10 ROM version display
F13 Accumulated running time setting & display
F14 Forcibly speed up for running time (for programmed running)
F15 Diagnosis for E07 & CH2
F16 Display for the internal temperature
F17 Display for the current in motor
F19 Display for the vibration of shaker
F20 Auto limit function set
F21 Serial communication (ID) set
F22 Serial communication mode set
F23 Rotational acceleration setting
F24 Revolution zero adjustment

Setting procedure: In PV display, keep pressing ⏫ key over 5seconds to display "F00".
Input the desired function code with ⏫ key and ⏩ key.
Press SET key to be function mode available.
Note) You should input service code in F06 prior to use F09, F10, F13~F17, F19, F20, and F24.
To cancel service code, input "000" in F06 or turn the power off.

F00: <Purpose> Simply passing through if entered by mistake.
<Operation> Press ENT key in "F00" displayed to revert to PV display.

F06: <Purpose> Dividing F-code for customer used from service
<Operation> Input F06 and press SET key to display "000" (initial value).
Set to "384" with ⏫ key and ⏩ key. Press SET key to store the value and revert to PV display.
<Cancel> Input F06 and press SET key to display "000".
Change to "384" with ⏫ key and ⏩ key. Press ENT key to revert to PV display and the desired function is available.
Note) "384" is not stored in non-volatile memory if "000" is set in F06 again or the power is turned off. Turn the power off when you finish servicing.

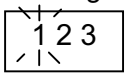
F09: <Purpose> Non-volatile memory initialization
<Operation> **This mode should be used only when data can't be restored in non-volatile memory.**
Input service code in F06 prior to use this mode.
Input F09 and press ENT key to display "00.0" (initial value).
Change the 1st digit to "1" and press ENT key to initialize the data in non-volatile memory except for follows;

- Zero adjustment (F11)
- Revolution zero adjustment data (F24)
- Accumulated running time (F13)
- Service code "384" (F06)

<Initial values in non-volatile memory>
Revolution: 50 rpm
Running time: 00.0 hr (continuous run)
Communication ID: 000
Communication mode: 000
Check code: 114 (=0x72)
Abnormal vibration level: 5
Rotational acceleration level: 2
Key lock: 0 (OFF)

<Values to be stored in non-volatile memory to prevent being eliminated in power failure>
Running time: 0
Status flag byte: 0
6 min. timer: 360

F10: <Purpose> ROM version display
<Operation> Input service code in F06 prior to use this mode.
Input F10 and press ENT key to display the current ROM version.
Ex) Ver.1.2 ⇒ Displays as “u1.2”

F13: <Purpose> Accumulated running time setting
<Operation> Input service code in F06 prior to use this mode.
Input F13 and press ENT key to display accumulated running time and its 3rd digit (left digit) blinks.
Ex.) accumulated running time is “12345 hours”
Displays as 

Note) 2 digits, 4 & 5 are not displayed

At the time press ENT key to revert to PV display.
When you replace consumable components, set “000” with ⏫ key and ⏩ key then press ENT key to reset the accumulated running time to “0”.
In continuous running, when the accumulated running time is reached to 99.9 hours, shaker accumulates 99.9hours then runs continuously from 0.
In case speed-up running it set in F14, its running time is not accumulated.

F14: <Purpose> Forcibly speed up the running time
<Operation> Input service code in F06 prior to use this mode.
This mode should be used when you check programmed running.
Input F14 and press ENT key to blink the 1st digit (right digit) then set “1” to be forcibly speed up the running time.
At the time set “0” to be this mode inoperative.
In this mode, counts 0.1hours as 1second.
It sets at “0” when the power is supplied.

F15: <Purpose> Diagnosis for E07 & CH2
<Operation> Input service code in F06 prior to use this mode.
Input F15 and press ENT key to blink the 1st digit (right digit) then set “0” to be diagnosis available.
At the time set “1” to be this mode inoperative.
It sets at “0” when the power is supplied.

F16: <Purpose> Displays the internal temperature
<Operation> Input service code in F06 prior to use this mode.
Input F16 and press ENT key to display the current internal temperature.
Ex) 12.3℃ ⇒ Displays as “12.3”

F17: <Purpose> Exchange the current in motor to the voltage
<Operation> Service code should be input in F06 prior to use this mode.
Input F17 and press ENT key to display the voltage. The resistance 0.22Ω is amplified 20times.
The calculation for the displayed value is current x 0.22Ω x 20.
Ex) 1.23V ⇒ Displays as “123”

The voltage in motor (reference only)

Setting revolution (rpm)	No load	Load (2Kg)
50	0.24V ~ 0.34V	0.25V ~ 0.33V
100	0.36V ~ 0.43V	0.35V ~ 0.45V
150	0.50V ~ 0.54V	0.50V ~ 0.54V
200	0.63V ~ 0.67V	0.66V ~ 0.69V
250	0.77V ~ 0.81V	0.76V ~ 0.82V
300	0.91V ~ 0.94V	0.95V ~ 0.99V
350	1.06V ~ 1.10V	1.07V ~ 1.12V
400	1.20V ~ 1.25V	1.25V ~ 1.30V
450	1.35V ~ 1.40V	1.39V ~ 1.45V
500	1.50V ~ 1.55V	1.58V ~ 1.63V

F19: <Purpose> Displays the vibration forth and back
<Operation> Service code should be input in F06 prior to use this mode.
Input F19 and press ENT key to display vibration level.
Sensor output voltage is amplified then displayed.
Ex) 1.23V ⇒ Displays as “123”

F20: <Purpose> Auto limit function setting
<Operation> Service code should be input in F06 prior to use this mode.
Input F20 and press ENT key to display Auto limit setting level, 1~9.
Blinking digit should be changed to desired value with ⏫ key.

F21: <Purpose> Serial communication ID setting
<Operation> Input F21 and press ENT key to display “000”.
Input serial communication ID (the number to identify the shaker) and press ENT key to set serial communication ID.
Setting range is “000”~”255”.
000: Communication OFF

F22: <Purpose> Serial communication mode setting
<Operation> input F22 and press ENT key to display “000” (initial value)
Change the value with ⏫ key and ⏭ key.
Control mode (the 3rd digit)
0: Local (initial)
1: Remote
Baud rate (the 2nd digit)
0: 2400bps (initial)
1: 4800bps
2: 9600bps
Note) You cannot be changed SV if control mode is set in “Remote”.

F23: <Purpose> Set rotational acceleration (speed to reach setting revolution)
<Operation> Input F23 and press ENT key to select desired value among 3steps 1~3 (3 is the fastest).

F24: <Purpose> Revolution speed adjustment
<Operation> Service code should be input in F06 prior to use this mode.
In revolution stable at 300rpm, set F24 and press ENT key to display rotation speed to be changed. (initial 300)
Set the value which was read by taco-meter with ⏫ key and ⏭ key.
Press ENT key to store the value. Every time the setting value is changed, adjustment value should be calculated and subtracted from the reading revolution.
Setting range: 240~360 rpm

8. Remote alarm

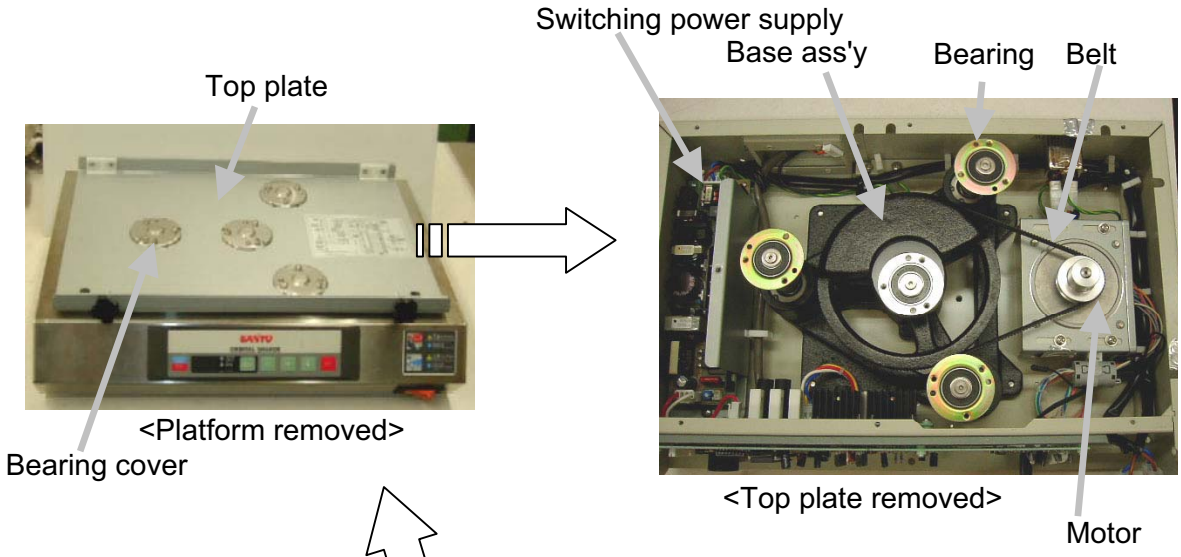
None

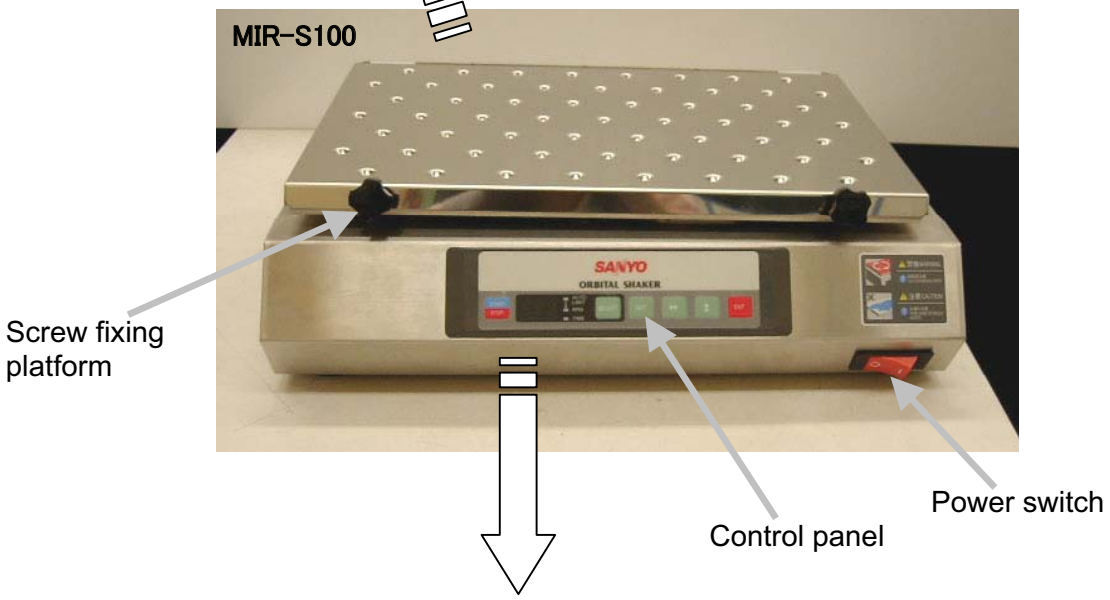
Specifications of sensor

■ Temperatures of temp. sensor (103AT-1) and the resistance values.

Temperature (℃)	Resistance value (kΩ)	Temperature (℃)	Resistance value (kΩ)	Temperature (℃)	Resistance value (kΩ)
0	27.28	28	8.94	56	3.43
1	26.13	29	8.64	57	3.32
2	25.03	30	8.31	58	3.22
3	23.99	31	8.02	59	3.12
4	22.99	32	7.73	60	3.02
5	22.05	33	7.46	61	2.93
6	21.15	34	7.19	62	2.84
7	20.29	35	6.94	63	2.75
8	19.48	36	6.70	64	2.67
9	18.70	37	6.47	65	2.59
10	17.96	38	6.25	66	2.51
11	17.24	39	6.03	67	2.44
12	16.55	40	5.83	68	2.37
13	15.90	41	5.63	69	2.30
14	15.28	42	5.44	70	2.23
15	14.68	43	5.26	71	2.16
16	14.12	44	5.08	72	2.10
17	13.57	45	4.91	73	2.04
18	13.06	46	4.75	74	1.98
19	12.56	47	4.59	75	1.92
20	12.09	48	4.44	76	1.87
21	11.63	49	4.30	77	1.82
22	11.20	50	4.16	78	1.77
23	10.78	51	4.02	79	1.72
24	10.38	52	3.90	80	1.67
25	10.00	53	3.77	81	1.62
26	9.63	54	3.65	82	1.58
27	9.28	55	3.54	83	1.53

Parts layout

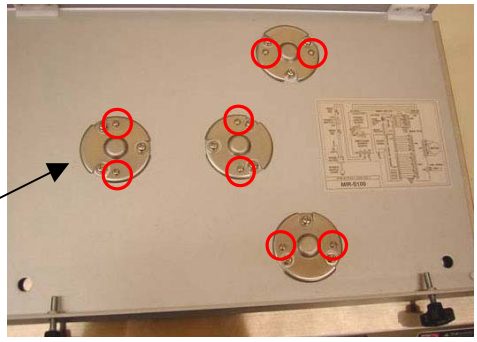




Replacement of the bearing

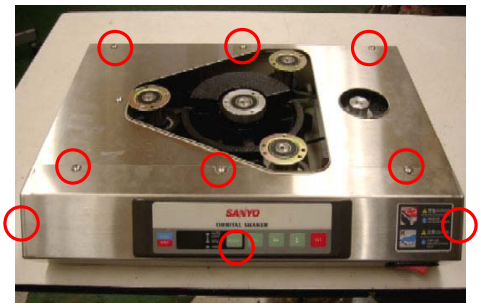
Replacing the bearing of Base ass'y

1 Loosen and remove the screws fixing each bearing cover.

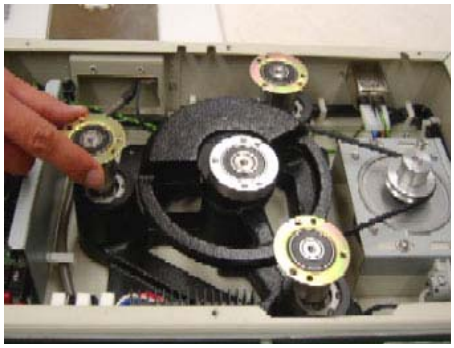


2 Take the hex screws off and remove 12 screws fixing the bearing.
Put the wrench in the point-A to prevent the bearing from turning.

3 Take 5 screws fixing the control panel and 5 screws fixing the frame cover off.



4 Take the guide housing and the center housing off.



5 Catch both of picks of the bearing by appropriate pincers to release the C-ring.

Catch both of picks by pincers.

The bearing with C-ring released

6 Pull the guide shaft bearing out.

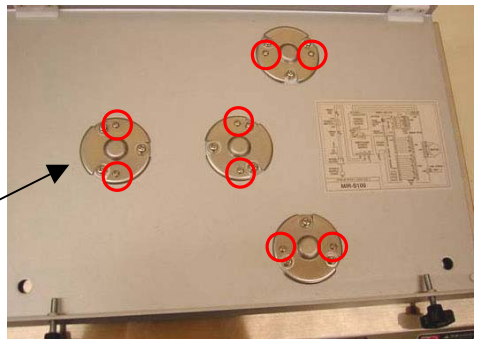
7 To pull the rest of bearings (2 pcs.) out, follow the procedure 4~5.

8 Spread silicone grease over the base ass'y prior to mount the bearing ass'y.

* *Note*
Ensure the flat side of C-ring should be faced with the base ass'y.

Replacing the bearing of Top plate ass'y

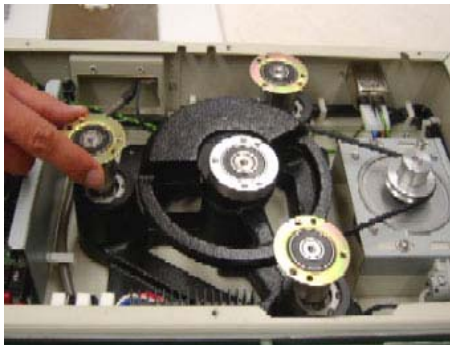
1 Loosen and remove the screws fixing each bearing cover.



2 Take the hex screws off and remove 12 screws fixing the bearing.
Put the wrench in the point-A to prevent the bearing from turning.

3 Take 5 screws fixing the control panel and 5 screws fixing the frame cover off.

4 Take the bearing ass'y (4pcs.) off the each shaft.



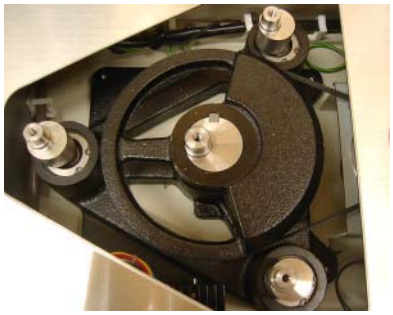
5 Align the new bearing ass'y and replace with the top plate correctly.
Tighten the screws with 245N/cm (25kgf/cm).

Ensure the proper orientation of center housing.

Side to face with Top plate

Side to face with Base ass'y

6 Align the guide shaft and the center shaft to mount the top plate.

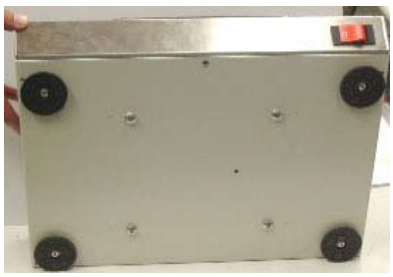


7 Mount the Top plate ass'y in procedure 1~2 reverse order.
12 screws fixing the bearing should be tighten with 343~392N/cm (35~40kgf/cm).

See Instruction manual, "Replacement of consumable" in page 18 as for the timing to replacing bearings..

Replacement of the Base Assy'

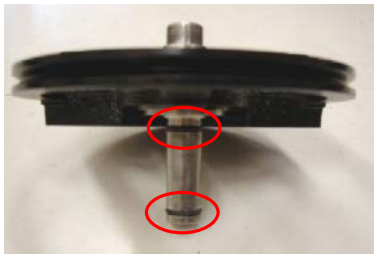
1 Loosen and remove 4 screws from the bottom to take the base ass'y off.



2 Remove the hex screws from the bottom of the base ass'y.

3 Turn the base ass'y on upside to pull the center shaft ass'y out.

4 Ensure the O-ring should not be torn or cracked.
In case it is damaged, replace with the new one.



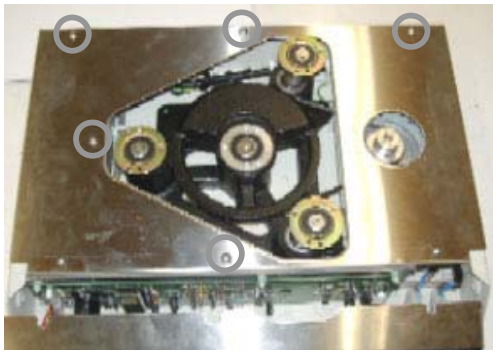
5 Follow the procedure 1~4 in reverse order to mount the base ass'y.
Note: Tighten the hex screws with 245N/cm (25kgf/cm).

Replacement of the belt

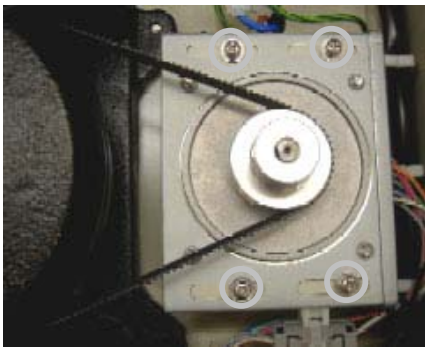
1 Take the top plate off.
For the procedure, refer to "Replacement of the bearing" in page 17.

2 Loosen and remove 5 screws which are fixed with the control panel.

3 Loosen and remove 5 screws which are fixed with the frame cover.

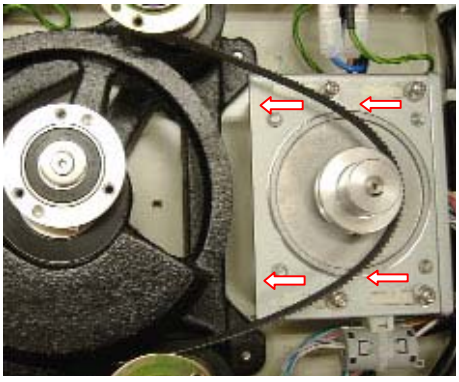


4 Loosen the 4 screws which are fixed the plate fixing the motor.



<The belt stretched tight>

5 Slide the plate fixing the motor toward left to make the belt loosen.
Take the belt off to replace the new one.



<The belt without stretched>

6 After the replacing the belt, slide the plate fixing the motor back and tighten the 4 screws.

7 To check the belt tension with the selectable procedure a) or b) as follow.

Tool: Tension meter or spring balance

a) Measure the the belt tension with the tension meter, it should be 16.5±2.5(N).
b) With the belt stretched tight, Load 1.1±0.2(N) on the center of the belt and measure the bending with the spring balance. The bending should be 1.23mm.

<Note>
(1) The gap of the height between the pully and the motor should be within ±0.77mm.
(2) The torque to tighten the screw fixing the plate should be 245N.cm (25kgf/c m).

8 Follow the procedure 1.~ 6. in reverse order.

*** See "Replacement of consumable" on page 43 of the Instruction Manual for the timing of replacing the belt.**